FORM PTO-1390
REV. 5-93

US DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEYS DOCKET NUMBER	U.S. APPLICATION NO. (if known, see 37 CFR 1.5)
P00,1957	09/744079

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/DE99/01946	01 JULY 1999	22 JULY 1998

TITLE OF INVENTION
METHOD FOR SWITCHING DATA RECEIVED VIA A PACKET-ORIENTED DATA TRANSMISSION PATH

APPLICANT(S) FOR DO/EO/US
KLAUS HÜNLICH ET AL.

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay.
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of International Application as filed (35 U.S.C. 371(c)(2)) - drawings attached.
   a. ☒ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ has been transmitted by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US)
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2) - drawings attached.
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. §371(c)(3))
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☒ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☒ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 C.F.R. 1.97 and 1.98; **(PTO 1449, Prior Art, Search Report, 07 References).**
12. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 C.F.R. 3.28 and 3.31 is included. **(SEE ATTACHED ENVELOPE)**
13. ☒ Amendment "A" Prior to Action with attached Appendix "A".
    ☐ A SECOND or SUBSEQUENT preliminary amendment.
14. ☒ A substitute specification and Mark-Up for Substitute Specification.
15. ☒ A change of address letter attached to the Declaration.
16. ☒ Other items or information:
    a. ☒ Request for Approval of Drawing Additions
    b. ☒ Appointment of Associate Power of Attorney
    c. ☒ EXPRESS MAIL #EL655302700US dated January 19, 2001.

U.S. APPLICATION NO. (if known, see 37 C.F.R. 1.5)	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
09/744079	PCT/DE99/01946	P00,1957

17. ☒ The following fees are submitted:

	CALCULATIONS	PTO USE ONLY
BASIC NATIONAL FEE (37 C.F.R. 1.492(a)(1)-(5): Search Report has been prepared by the EPO or JPO $860.00		
International preliminary examination fee paid to USPTO (37 C.F.R. 1.482) .. $690.00		
No international preliminary examination fee paid to USPTO (37 C.F.R. 1.482) but international search fee paid to USPTO (37 C.F.R. 1.445(a)(2) $710.00		
Neither international preliminary examination fee (37 C.F.R. 1.482) nor international search fee (37 C.F.R. 1.445(a)(2) paid to USPTO $1000.00		
International preliminary examination fee paid to USPTO (37 C.F.R. 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) ..... $ 100.00		
ENTER APPROPRIATE BASIC FEE AMOUNT =	$ 860.00	
Surcharge of $130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 C.F.R. 1.492(e)).	$	

Claims	Number Filed		Number Extra	Rate		
Total Claims	07	- 20 =	0	X $ 18.00	$	
Independent Claims	01	- 3 =	0	X $ 80.00	$	
Multiple Dependent Claims				$270.00+	$	
TOTAL OF ABOVE CALCULATIONS =					$ 860.00	
Reduction by ½ for filing by small entity, if applicable. Verified Small Entity statement must also be filed. (Note 37 C.F.R. 1.9, 1.27, 1.28)					$	
SUBTOTAL =					$ 860.00	
Processing fee of $130.00 for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)). +					$	
TOTAL NATIONAL FEE =					$ 860.00	
Fee for recording the enclosed assignment (37 C.F.R. 1.21(h). The assignment must be accompanied by an appropriate cover sheet (37 C.F.R. 3.28, 3.31). $40.00 per property +						
TOTAL FEES ENCLOSED =					$ 860.00	
					Amount to be refunded	$
					charged	$

a. ☒ A check in the amount of $ 860.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. _____ in the amount of $ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. **50-1519**. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 C.F.R. 1.494 or 1.495 has not been met, a petition to revive (37 C.F.R. 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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BOX PCT
IN THE UNITED STATES DESIGNATED/ELECTED OFFICE
OF THE UNITED STATES PATENT AND TRADEMARK OFFICE
UNDER THE PATENT COOPERATION TREATY--CHAPTER II

APPLICANT(S):	KLAUS HÜNLICH ET AL.
ATTORNEY DOCKET NO.:	P00,1957
INTERNATIONAL APPLICATION NO:	PCT/DE 99/01946
INTERNATIONAL FILING DATE:	01 JULY 1999
INVENTION:	METHOD FOR SWITCHING DATA RECEIVED VIA A PACKET-ORIENTED DATA TRANSMISSION PATH

Assistant Commissioner for Patents,
Washington D.C. 20231

AMENDMENT A PRIOR TO ACTION

Sir:

Applicants herewith amend the above-referenced PCT application, and request entry of the Amendment prior to examination on the United States Examination Phase.

IN THE CLAIMS:

On substitute page 10:

replace line 1 with --WHAT IS CLAIMED IS:--;

Please replace original claims 1- 7 with the following rewritten claims 1-7, referring to the mark-ups in Appendix A.

1. (Amended) A method for switching data that are received via a packet-oriented data transmission link and are to be forwarded, in which data packets subdivided into sub-structure elements are established for a data transmission via said packet-oriented data transmission link, comprising the steps of:

allocating, by a conversion unit, an allocation of said data received via said packet-oriented data transmission link to channels of a timeslot-oriented data format formed of a periodic sequence of channel-individual information segments, such that

data allocated to a sub-structure element are allocated to at least one channel of said timeslot-oriented data format;

switching said data converted into said timeslot-oriented data format via a timeslot-oriented switching network module;

converting said timeslot-oriented data back into said packet-oriented data format; and

transmitting said data coverted back into said packet-oriented data format via said packet-oriented data transmission link.

2. (Amended) The method according to claim 1, wherein said step of transmitting data via said packet-oriented data transmission link ensues according to the asynchronous transfer mode data format.

3. (Amended) The method according to claim 1, further comprising the step of:

reserving a sub-structure element for a transmission of signaling information allocated to data transmitted via said packeted-oriented data transmission link.

4. (Amended) The method according to claim 3, further comprising the steps of:

receiving signaling information by said conversion unit;

communicating said received signaling information from said conversion unit to a control unit; and

coverting said signaling information into switching-oriented control data for said timeslot-oriented switching network module.

5. (Amended) The method according to claim 1, further comprising the step of:

inserting filler cells for an adaptation of a transmission bit rate deriving due to an arrival and size of sub-structure elements to a transmission bit rate of a channel.

6. (Amended) The method according to claim 1, further comprising the step of:

inserting filler data into a sub-structure element for an adaptation of a transmission bit rate deriving due to an arrival and a size of sub-structure elements to a transmission bit rate of a channel.

7. (Amended) The method according to claim 6, further comprising the step of:

transmitting, for each channel, information about a plurality of payload data communicated in a channel and information about a plurality of filler data communicated in said channel.

REMARKS

The present Amendment revises the specification and claims to conform to United States patent practice, before examination of the present PCT application in the United States National Examination Phase. Pursuant to 37 CFR 1.125 (b), applicants have concurrently submitted a substitute specification, excluding the claims, and provided a marked-up copy. All of the changes are editorial and applicant believes no new matter is added thereby. The amendment of the claims is not intended to be a surrender of any of the subject matter of those claims.

Early examination on the merits is respectfully requested.

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Appendix A
Mark Ups for Claims

This redlined draft, generated by CompareRite (TM) - The Instant Redliner, shows the differences between -
original document : Q:\DOCUMENTS\YEAR 2000\P001957-HUENLICH\ORIGINAL CLAIMS.DOC
and revised document: Q:\DOCUMENTS\YEAR 2000\P001957-HUENLICH\AMENDED CLAIMS.DOC

CompareRite found 64 change(s) in the text

Deletions appear as Overstrike text surrounded by []
Additions appear as Bold-Underline text

1. [~~Method~~]**(Amended) A method** for switching data that are received via a packet-oriented data transmission link and are to be forwarded, [~~whereby~~] **in which** data packets [~~(ATM-Z1, ATM-Z2)~~] subdivided into sub-structure elements [~~(SE)~~] are established for a data transmission via [~~the~~] **said** packet-oriented data transmission link, [~~characterized in that~~]

]comprising the steps of:

allocating, by a conversion unit, an allocation of [~~the~~] **said** data received via [~~the~~] **said** packet-oriented data transmission link to channels of a timeslot-oriented data format [~~TDM~~] formed of a periodic sequence of channel-individual information segments [~~is undertaken such by a conversion unit (UE) that the~~]**, such that** data allocated to a sub-structure element [~~(SE)~~] are allocated to at least one channel of [~~the~~] **said** timeslot-oriented data format[~~(TDM);~~]**;**

[~~in that a~~] switching [~~of the~~] **said** data converted into [~~the~~] **said** timeslot-oriented data format [~~ensues~~] via a timeslot-oriented switching network module[~~(KN); and~~]**;**

[~~in that the~~] **converting said** timeslot-oriented data [~~are converted~~] back into [~~the~~] **said** packet-oriented data format [~~and are transmitted via the~~]**; and**

transmitting said data coverted back into said packet-oriented data format via said packet-oriented data transmission link.

2. [~~Method~~]**(Amended) The method** according to claim 1, [~~characterized in that a data transmission via the~~] **wherein said step of transmitting data via said** packet-oriented data transmission link ensues according to the [ATM] **asynchronous transfer mode** data format[~~(asynchronous transfer mode).~~].

[~~3. Method~~] **3. (Amended) The method** according to [~~one of the preceding claims, characterized in that~~] **claim 1, further comprising the step of:**

reserving a sub-structure element [~~(SE) is reserved for the~~] **for a** transmission of signaling information allocated to data transmitted via [~~the~~] **said** packeted-oriented data transmission link.

4. [~~Method~~]**(Amended) The method** according to claim 3, [~~characterized in that the~~]**further comprising the steps of:**

receiving signaling information by said conversion unit;

communicating said received signaling information [~~are communicated~~] from [~~the~~] **said** conversion unit [~~(UE)~~] to a control unit[~~(STE) wherein the~~]**; and**

coverting said signaling information [~~are converted~~] into switching-oriented control data for [~~the~~] **said** timeslot-oriented switching network module[~~(KN)~~].

5. [~~Method~~]**(Amended) The method** according to [~~one of the preceding claims, characterized in that~~] **claim 1, further comprising the step of:**

inserting filler cells [~~(FZ) are inserted~~] for an adaptation of [~~the~~] **a** transmission bit rate deriving due to [~~the~~] **an** arrival and [~~the~~] size of sub-structure elements [~~(SE)~~] to [~~the~~] **a** transmission bit rate of a channel.

6. [~~Method~~]**(Amended) The method** according to [~~one of the claims 1 through 4, characterized in that~~] **claim 1, further comprising the step of:**

inserting filler data [~~(FD) are inserted~~] into a sub-structure element [~~(SE)~~] for an adaptation of [~~the~~] **a** transmission bit rate deriving due to [~~the~~] **an** arrival and [~~the~~] **a** size of sub-structure elements [~~(SE)~~] to [~~the~~] **a** transmission bit rate of a channel.

7. [Method](Amended) **The method** according to claim 6, [characterized in that an] **further comprising the step of:**

transmitting, for each channel, information about [the] **a** plurality of payload data communicated in [the] **a** channel and [an] information about [the] **a** plurality of filler data [(FD)] communicated in [the channel is transmitted for each] **said** channel.

SPECIFICATION

TITLE

METHOD FOR SWITCHING DATA RECEIVED VIA A PACKET-ORIENTED DATA TRANSMISSION PATH

BACKGROUND OF THE INVENTION

Field of the Invention

1 The invention is directed to a method for switching data that are received via a packet-oriented data transmission link and are to be forwarded.

Description of the Related Art

2 The significance of transmission and switching techniques for high data transmission rates (above 100 Mbit/s) is increasing due to the increasing need for a transmission of video information in modern communications technology. Such video information may include still and moving images in picture telephony applications or the presentation of high-resolution graphics at modern data processing systems.

3 A known data transmission method for high transmission bit rates is the "asynchronous transfer mode" (ATM). A data transmission on the basis of the asynchronous transfer mode currently enables a variable transmission bit rate of up to 622 Mbit/s. In this transfer mode, data packets having a fixed length ("ATM cells") are used for the data transport. An ATM cell is composed of a cell header that is five bytes long and contains the switching data relevant for the transport of an ATM cell and of a 48 byte long payload field. Only data allocated to one logical connection – frequently referred to as a virtual channel VC or ATM channel – are transmitted in the payload field of an ATM cell.

4 US patent no. 5,784,371 discloses a communication network formed of a plurality of communication systems that are connected to one another via an ATM network. The communication systems respectively comprise a timeslot-oriented switching network module for a connection of timeslot-oriented terminal devices to the respective communication system, by which a bidirectional switching of data to

be exchanged between the device and the packet-oriented ATM network ensues with the timeslot-oriented switching network modules.

5 The German Patent Application serial number 198 187 76.9 discloses a method that enables a transmission of data belonging to different logical connections in the payload region of one or several ATM cells. To this end, "sub-structure elements" having a variable payload field 0 through 64 bytes long is defined in the payload field of an ATM cell, these sub-structure elements being capable of being respectively allocated to a logical connection via an address field in the cell header of the sub-structure element. Due to the 8-bit long address field in the cell header of a sub-structure element, a maximum of $2^8 = 256$ different logical connections can be addressed. Additionally, at least one sub-structure element is reserved for a transmission of signaling information allocated to the logical connections.

6 The article by Mauger, R., et al., "ATM Adaptation Layer Switching" ISS, World Telecommunications Congress (International Switching Symposium), Ca, Toronto, Pinnacle group, pages 207-214, XP000720525, discloses an arrangement for a switching of data received via a timeslot-oriented data transmission link and a packet-oriented data transmission link. This arrangement comprises both a timeslot-oriented switching network module as well as a packet-oriented switching network module. A switching of data received via the packet-oriented data transmission link and to be forwarded via a packet-oriented data transmission link as well takes place with the packet-oriented switching network module.

SUMMARY OF THE INVENTION

7 An object of the present invention is to specify an alternative method that enables a switching of data that are received via a packet-oriented data transmission link and are to be forwarded.

8 This object is achieved by a method for switching data that are received via a packet-oriented data transmission link and are to be forwarded, in which data packets subdivided into sub-structure elements are established for a data transmission via the packet-oriented data transmission link, comprising the steps of

allocating, by a conversion unit, an allocation of the data received via the packet-oriented data transmission link to channels of a timeslot-oriented data format formed of a periodic sequence of channel-individual information segments, such that data allocated to a sub-structure element are allocated to at least one channel of the timeslot-oriented data format; switching the data converted into the timeslot-oriented data format via a timeslot-oriented switching network module; converting the timeslot-oriented data back into the packet-oriented data format; and transmitting the data coverted back into the packet-oriented data format via the packet-oriented data transmission link.

9 A critical advantage of the inventive method is that a switching of data allocated to different logical connections and transmitted in one or several data cells can ensue via a traditional timeslot-oriented switching network module. A development of a switching network module designed for the present packet-oriented data format and a signaling adapted to it are thus not necessary.

10 Advantageous developments of the invention include providing that the step of transmitting data via the packet-oriented data transmission link ensues according to the asynchronous transfer mode data format. The inventive method may also include reserving a sub-structure element for a transmission of signaling information allocated to data transmitted via the packeted-oriented data transmission link. Further steps may be added including receiving signaling information by the conversion unit; communicating the received signaling information from the conversion unit to a control unit; and coverting the signaling information into switching-oriented control data for the timeslot-oriented switching network module. Filter cells may be inserted for an adaptation of a transmission bit rate deriving due to an arrival and size of sub-structure elements to a transmission bit rate of a channel. A further step may include inserting filler data into a sub-structure element for an adaptation of a transmission bit rate deriving due to an arrival and a size of sub-structure elements to a transmission bit rate of a channel. Finally the inventive method may include transmitting, for each channel, information about a plurality of payload data communicated in a channel and information about a plurality of filler data communicated in the channel.

11 One advantage of developments of the invention is that, among other things, the insertion of filler cells or of filler data into a sub-structure element during the conversion of a packet-oriented data format into a timeslot-oriented data format makes a switching of compressed data possible without a preceding decompression, which avoids a quality loss in the switching of compressed data.

BRIEF DESCRIPTION OF THE DRAWINGS

12 An exemplary embodiment of the invention is explained in greater detail below on the basis of the drawings.

Figure 1 is a block diagram of the schematic illustration of the critical function units participating in the inventive method;

Figure 2 is a data structure diagram of the schematic illustration of the conversion of a packet-oriented data format into a timeslot-oriented data format according to a first operating mode of a conversion unit; and

Figure 3 is a data structure diagram of the schematic illustration of the conversion of the packet-oriented data format into the timeslot-oriented data format according to a second operating mode of the conversion unit.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

13 Figure 1 shows a schematic illustration of a communication system PBX. The communication system PBX comprises subscriber or network line/trunk modules -- a line/trunk module ABG is shown by way of example -- for the connection of communication terminal devices or for a connection to a communication network -- for example, an ISDN-oriented communication network, an analog communication network, a radio communication network or an ATM-based communication network.

14 Furthermore, the communication system PBX contains a timeslot-oriented switching network module KN comprising a plurality of bidirectional, time-division multiplex-oriented switching terminals KA, where the time-division multiplex-oriented switching terminals KA are fashioned as PCM terminals (pulse code modulation), also referred to as PCM highways, speech highways or S_{2M} terminals. Given an internal data transmission of the communication system, a PCM highway generally

comprises 32 payload channels that are fashioned as ISDN (integrated services digital network)-oriented B-channels with a respective transmission bit rate of 64 kbit/s.

15 A line unit AE and a conversion unit UE are arranged on the line/trunk module ABG. The communication system PBX is connected to an ATM-based communication network ATM-KN via a network interface NA of the line unit AE, the ATM-based communication network ATM-KN being composed of a plurality of communication systems connected to one another. A first and a second communication terminal device KE-A, KE-B are connected to the ATM-based communication network ATM_KN. The line unit AE is connected to a bidirectional, packet-oriented terminal SK of the conversion unit UE via a its own bidirectional, packet-oriented terminal SK.

16 The conversion unit UE is also connected to a switching terminal KA of the timeslot-oriented switching network module KN via its own bidirectional, time-division multiplex-oriented switching terminal KA. The timeslot-oriented switching network module KN is respectively connected, via further switching terminals KA (not shown), to a bidirectional time-division multiplex-oriented terminal SK of further subscribers or line/trunk modules (not shown) arranged in the communication system PBX.

17 A bidirectional conversion between the packet-oriented data format of a connecting line PO-VL between the conversion unit UE and the line unit AE and the timeslot-oriented data format of a connecting line ZO-VL between the conversion unit UE and the timeslot-oriented switching network module KN ensues with the conversion unit UE according to two different operating modes of the conversion unit UE that are described in greater detail below.

18 Furthermore, a control unit STE comprising a plurality of control terminals S1, S2 is arranged in the communication system PBX. The control unit STE is connected to a control input SE of the timeslot-oriented switching network module KN via a control terminal S2, and is connected to a control input SE of the line/trunk module ABG via a control terminal S1. The control unit STE is connected to control inputs of further subscribers or line/trunk modules arranged in the communication system PBX via further control terminals (not shown). A communication of signaling

information between the control unit STE and the timeslot-oriented switching network module KN or the line/trunk module ABG ensues according to the HDLC data format (high level data link control).

19 Figure 2 shows a schematic illustration of a conversion of the packet-oriented ATM data format according to the ATM adaption layer AAL type 2 into the timeslot-oriented data format according to the TDM method (time-division multiplex) in a first operating mode of the conversion unit UE. A data transmission in the framework of the packet-oriented ATM data format ensues via ATM cells ATM-Z1, ATM-Z2. An ATM cell ATM-Z1, ATM-Z2 is composed of a five byte long cell header H containing the switching data relevant for the transport of an ATM cell ATM-Z1, ATM-Z2 and of a 48 byte long payload field.

20 In a data transmission in the framework of the packet-oriented ATM data format according to the ATM adaption layer AAL type 2, there is the possibility of subdividing the payload area of an ATM cell ATM-Z1, ATM-Z2 into sub-structure elements SE. The adaptation of the ATM data format -- also frequently referred to as "ATM layer" (layer 2) in the literature -- to the switching layer (layer 3) according to the OSI (open systems interconnection) reference model takes place with the "ATM adaption layer" AAL.

21 A sub-structure element SE according to the ATM adaption layer AAL type 2 is composed of a 3 byte long cell header and of a variable-length payload area I (0 through 64 bytes). The cell header of a sub-structure element SE is subdivided into an 8 bit long channel identifier CID, a 6 bit long length indicator LI, a 5 bit long transmitter-receiver indication UUI (user-to-user indication) and a 5 bit long cell header checksum HEC (header error control).

22 As a result of the subdivision of an ATM connection with the assistance of sub-structure elements SE into mutually independent data streams, as shown in Figure 2 with reference to the example of the ATM cells ATM-Z1, ATM-Z2, up to 2^8 = 256 different logical connections can be addressed within an ATM connection of the basis of the 8 bit long channel identifier CID, all of these logical connections being addressed with the same ATM address -- composed of a VPI (virtual path identifier) value and of a VCI (virtual channel identifier) value. In addition, there is the

possibility of defining a sub-structure element SE for a transmission of signaling information allocated to the logical connections. For a transmission of payload data allocated to the logical connections, one sub-structure element SE can be defined for every currently required logical connection, so that the transmission capacity can be exactly matched to the current need.

23 For example, four different sub-structure elements SE are shown in Figure 2 that are defined on the basis of different channel identifier CID in the cell header -- referred to below as the sub-structure element header 0, 1, 2, 3 -- of the sub-structure elements SE. A payload field I of variable length (0 through 2^6 bytes) can be defined by the 6 bit long length indicator LI in the cell header, so that a data transmission with a variable transmission bit rate can be realized for the different logical connections.

24 For a conversion of the packet-oriented data format according to the ATM adaption layer AAL type 2 onto the timeslot-oriented data format according to the TDM method, a TDM channel K0 through K3 of the timeslot-oriented data format according to the TDM method is allocated to each element SE of an ATM cell ATM-Z1, ATM-Z2 defined for a transmission of payload data. An allocation of a sub-structure element SE to a TDM channel K0 through K3 ensues in a signaling phase preceding the payload transmission. 32 payload channels, which are configured as ISDN-oriented B-channels with a constant transmission bit rate of respectively 64 kbit/s, are generally available for a data transmission in the framework of the timeslot-oriented data format according to the TDM method.

25 In the framework of the conversion of the packet-oriented data format according to the ATM adaption layer AAL type 2 onto the timeslot-oriented data format according to the TDM method, an adaptation of the (potentially variable) transmission bit rate of the packet-oriented data format deriving due to the size and the arrival of sub-structure elements SE onto the constant transmission bit rate of 64 kbit/s of the timeslot-oriented data format must additionally ensue. This is achieved in the scope of the first operating mode of the conversion unit UE by an insertion of "filler cells" FZ of variable length into the continuous TDM data stream.

26 The sub-structure element SE received via the packet-oriented connecting line PO-VL and packed in ATM cells ATM-Z1, ATM-Z2 must be unpacked in the conversion unit UE. For the conversion of the (potentially variable) transmission bit rate deriving due to the size and the arrival of the sub-structure elements SE onto the constant transmission bit rate of 64 kbit/s of the timeslot-oriented data format, filler cells FZ are subsequently attached to the sub-structure elements SE containing the payload data. The length of a filler cell FZ is defined by a filler cell header FZH. The length of a filler cell FZ is selected such that the overall transmission bit rate of a sub-structure element SE and of a filler cell FZ yields a whole multiple of 64 kbit/s. When the transmission bit rate of a sub-structure element SE is higher than 64 kbit/s -- i.e., higher than the transmission bit rate of a TDM channel K1 through K4 -- the payload data communicated in a sub-structure element SE are divided onto a plurality of TDM channels K1 through K4.

27 In conclusion, these data (sub-structure elements SE and filler cells FZ together) are allocated to a TDM channel K0, K1 of the timeslot-oriented connecting line ZO-VL declared in the signaling phase and are transmitted via this to the timeslot-oriented switching network module KN.

28 The signaling information communicated from the conversion unit UE to the control unit STE of the communication system PBX in the framework of the signaling phase are converted in the control unit STE into switching-oriented control data for the timeslot-oriented switching network module KN. A switching of the data (sub-structure elements SE and filler cells FZ together) received via the respective TDM channels K0 through K3 of the timeslot-oriented connecting line ZO-VL ensues in the timeslot-oriented switching network module KN on the basis of the switching-oriented control data, i.e., an allocation of a TDM channel of an input line of the timeslot-oriented switching network module KN onto a TDM channel of an output line of the timeslot-oriented switching network module KN.

29 When the payload data to be communicated are to be transmitted anew via the ATM-based communication network ATM-KN to a receiver, the data (sub-structure elements SE and filler cells FZ together) are transmitted from the timeslot-oriented switching network module KN to the conversion unit UE, where the filler

cells FZ are removed from the TDM data stream, so that the data stream then only comprises sub-structure elements SE containing payload data. The sub-structure elements SE to be transmitted are packed in ATM cells ATM-Z1, ATM-Z2 in the conversion unit UE and are communicated via the ATM-based communication network ATM-KN to the addressed recipient. When the data are to be transmitted to, for example, an internal communication terminal device (not shown), then these are transmitted directly to a subscriber line module (not shown) via which the addressed communication terminal device is connected to the communication system PBX.

30 Figure 3 shows a schematic illustration of a conversion of the packet-oriented ATM data format according to the ATM adaption layer AAL type 2 into the timeslot-oriented data format according to the TDM method (time division multiplex) in a second operating mode of the conversion unit UE.

31 In contrast to the first operating mode of the conversion unit UE, no separate filler cells FZ are inserted into the continuous TDM data stream in the second operating mode. An adaptation of the (potentially variable) transmission bit rate of the packet-oriented data format to the constant transmission bit rate of 64 kbit/s of the timeslot-oriented data format ensues by filling the sub-structure elements SE with filler data FD, so that the overall transmission bit rate of a sub-structure element SE (payload data and filler data FD together) yields a whole multiple of 64 bit/s. This, however, assumes that each TDM channel K0 through K3 additionally has information about the length of the sub-structure elements SE that is transmitted and supplemented with filler data FD allocated to it such that a separation of the payload data to be transmitted from the filler data FD is enabled with the assistance of this information.

32 When, proceeding from the first communication terminal device KE-A, data are to be communicated to the second communication terminal device KE-B, the first communication terminal device KE-A sends the necessary signaling information to the communication system PBX in the framework of a signaling phase preceding the payload transmission, sending these information via a defined sub-structure element SE of a first ATM channel V-A, which is frequently abbreviated as VC

(virtual channel) in the literature. The transmitted signaling information are unpacked in the conversion unit UE, converted into the HDLC data format and communicated to the control unit STE.

33 On the basis of the communicated signaling information, a TDM channel -- for example, the TDM channel 17 -- of the timeslot-oriented connecting line ZO-VL is allocated to the sub-structure elements SE of the first ATM channel V-A that are defined for the transmission of the payload data from the first communication terminal device KE-A to the communication system PBX. Furthermore, the communicated signaling information are converted into switching-oriented control data for the timeslot-oriented switching network module KN. The switching-oriented control data define which input TDM channel -- for example, the TDM channel 17 of the timeslot-oriented connecting line ZO-VL -- is connected to which output TDM channel of the timeslot-oriented switching network module KN -- for example, the TDM channel 23 of the timeslot-oriented connecting line ZO-VL.

34 Subsequently, the first communication terminal device KE-A packs payload data to be transmitted into sub-structure elements SE that are in turn packed in ATM cells ATM-Z1, ATM-Z2 and subsequently communicated via the first ATM channel V-A to the communication system PBX. The sub-structure elements SE are unpacked from the ATM cells ATM-Z1, ATM-Z2 in the conversion unit UE. In a next step, the transmission bit rate deriving due to the size and the arrival of the sub-structure elements SE is matched to the constant transmission bit rate of 64 kbit/s by inserting filler cells FZ according to the first operating mode of the conversion unit UE.

35 The data -- composed of sub-structure elements SE and filler cells FZ -- are subsequently forwarded via the TDM channel 17 of the timeslot-oriented connecting line ZO-VL to the timeslot-oriented switching network module KN. The data are switched onto the TDM channel 23 of the timeslot-oriented connecting line ZO-VL by the timeslot-oriented switching network module KN and are sent back to the conversion unit UE. The filler cells FZ are removed from the continuous data stream in the conversion unit UE, so that the data stream is not composed only of sub-structure elements SE containing payload data. These sub-structure elements SE

are subsequently packed into ATM cells ATM-Z1, ATM-Z2 and transmitted to the second communication terminal device KE-B via a second ATM channel V-B.

36 The above-described method is illustrative of the principles of the present invention. Numerous modifications and adaptations thereof will be readily apparent to those skilled in this art without departing from the spirit and scope of the present invention.

ABSTRACT

37 Data packets (ATM-Z1, ATM-Z2) partitioned into substructure elements (SE) are set up for data transmission via the packet oriented data transmission path. Channels with a time slot oriented format (TDM) are assigned to the data received via the packet oriented data transmission path by a conversion unit (UE). The converted data is then switched via a time slot oriented switching matrix module (KN).

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SPECIFICATION

TITLE

METHOD FOR SWITCHING DATA RECEIVED VIA A PACKET-ORIENTED DATA TRANSMISSION PATH

BACKGROUND OF THE INVENTION

Field of the Invention

1 The invention is directed to a method for switching data that are received via a packet-oriented data transmission link and are to be forwarded.

Description of the Related Art

2 The significance of transmission and switching techniques for high data transmission rates (above 100 Mbit/s) is increasing due to the increasing need for a transmission of video information in modern communications technology [~~such as, for example,~~]. **Such video information may include** still and moving images in picture telephony applications or the presentation of high-resolution graphics at modern data processing systems.

3 A known data transmission method for high transmission bit rates is [~~what is referred to as the asynchronous~~] **the "asynchronous** transfer [~~mode~~] **mode"** (ATM). A data transmission on the basis of the asynchronous transfer mode currently enables a variable transmission bit rate of up to 622 Mbit/s. In [~~the transmission technique known as asynchronous~~] **this** transfer mode[~~(ATM)~~], data packets having a fixed length[~~, what are referred to as ATM cells,~~] **("ATM cells")** are used for the data transport. An ATM cell is composed of a cell header that is five bytes long and

contains the switching data relevant for the transport of an ATM cell and of a 48 byte long payload field. Only data allocated to one logical connection – frequently referred to as a virtual channel VC or ATM channel – ~~[in the literature are thereby]~~ **are** transmitted in the payload field of an ATM cell.

~~[US Published Application US-A-5784371]~~ **4** **US patent no. 5,784,371** discloses a communication network formed of a plurality of communication systems that are connected to one another via an ATM network. The communication systems respectively comprise a timeslot-oriented switching network module for a connection of timeslot-oriented terminal devices to the respective communication system, ~~[whereby]~~ **by which** a bidirectional switching of data to be exchanged ~~[bet [...]]~~ **between the** device and the packet-oriented ATM network ensues with the timeslot-oriented switching network modules.

5 The German Patent Application ~~[bearing the]~~ serial number 198 187 76.9 ~~[has already disclosed]~~ **discloses** a method that enables a transmission of data belonging to different logical connections in the payload region of one or~~[, respectively,]~~ several ATM cells. To this end, ~~[what are referred to as sub-]~~**"sub-**structure ~~[elements]~~ **elements"** having a variable payload field 0 through 64 bytes long is defined in the payload field of an ATM cell, ~~[said]~~ **these** sub-structure elements being capable of being respectively allocated to a logical connection via an address field in the cell header of the sub-structure element. Due to the 8-bit long address field in the cell header of a sub-structure element, a maximum of $2^8 = 256$ different logical connections can be addressed. Additionally, at least one sub-structure element is reserved for a transmission of signaling information allocated to the logical connections.

6 The article by Mauger, R., et al., "ATM Adaptation Layer Switching" ISS, World Telecommunications Congress (International Switching Symposium), Ca, Toronto, Pinnacle group, pages 207-214, XP000720525, discloses an arrangement for a switching of data received via a timeslot-oriented data transmission link and a packet-oriented data transmission link. ~~[The]~~ **This** arrangement ~~[thereby]~~ comprises both a timeslot-oriented switching network module as well as a packet-oriented switching network module. A switching of data received via the packet-oriented data transmission link and to be forwarded via a packet-oriented data transmission link as

well [~~thereby ensues~~] **takes place** with the packet-oriented switching network module.

SUMMARY OF THE INVENTION

7 An object of the present invention is to specify an alternative method [~~with which~~] **that enables** a switching of data that are received via a packet-oriented data transmission link and are to be forwarded [~~is enabled.~~]**.**

[~~Proceeding from the features of the preamble of patent claim 1, this object is inventively achieved by the characterizing features thereof.~~] **8 This object is achieved by a method for switching data that are received via a packet-oriented data transmission link and are to be forwarded, in which data packets subdivided into sub-structure elements are established for a data transmission via the packet-oriented data transmission link, comprising the steps of allocating, by a conversion unit, an allocation of the data received via the packet-oriented data transmission link to channels of a timeslot-oriented data format formed of a periodic sequence of channel-individual information segments, such that data allocated to a sub-structure element are allocated to at least one channel of the timeslot-oriented data format; switching the data converted into the timeslot-oriented data format via a timeslot-oriented switching network module; converting the timeslot-oriented data back into the packet-oriented data format; and transmitting the data coverted back into the packet-oriented data format via the packet-oriented data transmission link.**

9 A critical advantage of the inventive method is [~~then comprised therein~~] that a switching of data allocated to different logical connections and transmitted in one or[~~, respectively,~~] several data cells can ensue via a traditional timeslot-oriented switching network module. A development of a switching network module designed for the present packet-oriented data format and a signaling adapted [~~thereto~~] **to it** are thus not necessary.

10 Advantageous developments of the invention [~~are recited in the subclaims.~~] **include providing that the step of transmitting data via the packet-oriented data transmission link ensues according to the asynchronous transfer mode data format. The inventive method may also include reserving a sub-structure**

element for a transmission of signaling information allocated to data transmitted via the packeted-oriented data transmission link. Further steps may be added including receiving signaling information by the conversion unit; communicating the received signaling information from the conversion unit to a control unit; and coverting the signaling information into switching-oriented control data for the timeslot-oriented switching network module. Filter cells may be inserted for an adaptation of a transmission bit rate deriving due to an arrival and size of sub-structure elements to a transmission bit rate of a channel. A further step may include inserting filler data into a sub-structure element for an adaptation of a transmission bit rate deriving due to an arrival and a size of sub-structure elements to a transmIssion bit rate of a channel. Finally the inventive method may include transmitting, for each channel, information about a plurality of payload data communicated in a channel and information about a plurality of filler data communicated in the channel.

11 One advantage of developments of the invention ~~[defined in the subclaims is comprised]~~ **is that**, among other things, ~~[therein that]~~ the insertion of filler cells or~~[, respectively,]~~ of filler data into a sub-structure element during the conversion of a packet-oriented data format into a timeslot-oriented data format makes a switching of compressed data possible without **a** preceding decompression~~[. A]~~**, which avoids a** quality loss in the switching of compressed data ~~[is thus avoided.~~
~~]~~.

BRIEF DESCRIPTION OF THE DRAWINGS

12 An exemplary embodiment of the invention is explained in greater detail below on the basis of the **drawings.** ~~[drawing.~~
~~Thereby shown are:]~~

Figure 1 ~~[a structogram]~~ **is a block diagram** of the schematic illustration of the critical function units participating in the inventive method;

Figure 2 ~~[a structogram]~~ **is a data structure diagram** of the schematic illustration of the conversion of a packet-oriented data format into a timeslot-oriented data format according to a first operating mode of a conversion unit; **and**

Figure 3 ~~[a structogram]~~ **is a data structure diagram** of the schematic illustration of the conversion of the packet-oriented data format into the timeslot-oriented data format according to a second operating mode of the conversion unit.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

13 Figure 1 shows a schematic illustration of a communication system PBX. The communication system PBX comprises subscriber or~~[, respectively,]~~ network line/trunk modules ~~[B]~~-- a line/trunk module ABG is shown by way of example ~~[B]~~-- for the connection of communication terminal devices or~~[, respectively,]~~ for a connection to a communication network ~~[B]~~-- for example, an ISDN-oriented communication network, an analog communication network, a radio communication network or an ATM-based communication network.

~~[Further]~~ **14 Furthermore**, the communication system PBX contains a timeslot-oriented switching network module KN comprising a plurality of bidirectional, time-division multiplex-oriented switching terminals KA, ~~[whereby]~~ **where** the time-division multiplex-oriented switching terminals KA are fashioned as PCM terminals (pulse code modulation), also referred to as PCM highways, speech highways or S_{2M} terminals. Given an internal data transmission of the communication system, a PCM highway generally comprises 32 payload channels that are fashioned as ISDN ~~[-oriented B-channels]~~(integrated services digital network)**-oriented B-channels** with a respective transmission bit rate of 64 kbit/s.

15 A line unit AE and a conversion unit UE are arranged on the line/trunk module ABG. The communication system PBX is connected to an ATM-based communication network ATM-KN via a network interface NA of the line unit AE, ~~[said]~~ **the** ATM-based communication network ATM-KN being composed of a plurality of communication systems connected to one another. A first and a second communication terminal device KE-A, KE-B are connected to the ATM-based communication network ATM_KN. The line unit AE is connected to a bidirectional, packet-oriented terminal SK of the conversion unit UE via a **its own** bidirectional, packet-oriented terminal SK.

~~[[sic]~~

~~]~~**16** The conversion unit UE~~[, further,]~~ is **also** connected to a switching terminal KA of the timeslot-oriented switching network module KN via ~~[a]~~ **its own** bidirectional, time-division multiplex-oriented switching terminal KA. ~~[[sic] Via further switching terminals KA (not shown), the]~~ **The** timeslot-oriented switching network module KN is respectively connected**, via further switching terminals KA (not shown),** to a bidirectional time-division multiplex-oriented terminal SK of further ~~[subscriber or, respectively,]~~ **subscribers or** line/trunk modules (not shown) arranged in the communication system PBX.

17 A bidirectional conversion between the packet-oriented data format of a connecting line PO-VL between the conversion unit UE and the line unit AE and the timeslot-oriented data format of a connecting line ZO-VL between the conversion unit UE and the timeslot-oriented switching network module KN ensues with the conversion unit UE according to two different operating modes of ~~[said]~~ **the** conversion unit UE that are described in greater detail below.

~~[Further]~~ **18** **Furthermore**, a control unit STE comprising a plurality of control terminals S1, S2 is arranged in the communication system PBX. The control unit STE is connected to a control input SE of the timeslot-oriented switching network module KN via a control terminal S2, and is connected to a control input SE of the line/trunk module ABG via a control terminal S1. The control unit STE is connected to control inputs of further ~~[subscriber or, respectively,]~~ **subscribers or** line/trunk modules arranged in the communication system PBX via further control terminals (not shown). A communication of signaling information between the control unit STE and the timeslot-oriented switching network module KN or~~[, respectively,]~~ the line/trunk module ABG ~~[thereby]~~ ensues according to the HDLC data format (high level data link control).

19 Figure 2 shows a schematic illustration of a conversion of the packet-oriented ATM data format according to the ATM adaption layer AAL type 2 into the timeslot-oriented data format according to the TDM method (time-division multiplex) in a first operating mode of the conversion unit UE. A data transmission in the framework of the packet-oriented ATM data format ensues via ATM cells ATM-Z1, ATM-Z2. An ATM cell ATM-Z1, ATM-Z2 is composed of a five byte long cell header H containing

the switching data relevant for the transport of an ATM cell ATM-Z1, ATM-Z2 and of a 48 byte long payload field.

20 In a data transmission in the framework of the packet-oriented ATM data format according to the ATM adaption layer AAL type 2, there is the possibility of subdividing the payload area of an ATM cell ATM-Z1, ATM-Z2 into sub-structure elements SE. The adaptation of the ATM data format [B]-- also frequently referred to as ~~[AATM layer@]~~**"ATM layer"** (layer 2) in the literature [B]-- to the switching layer (layer 3) according to the OSI ~~[reference model]~~(open systems interconnection) ~~[thereby ensues with what is referred to as the ATM]~~ **reference model takes place with the "ATM** adaption ~~[layer]~~ **layer"** AAL.

21 A sub-structure element SE according to the ATM adaption layer AAL type 2 is composed of a 3 byte long cell header and of a variable-length payload area I (0 through 64 bytes). The cell header of a sub-structure element SE is subdivided into an 8 bit long channel identifier CID, a 6 bit long length indicator LI, a 5 bit long transmitter-receiver indication UUI (user-to-user indication) and a 5 bit long cell header checksum HEC (header error control).

22 As a result of the subdivision of an ATM connection with the assistance of sub-structure elements SE into mutually independent data streams, as shown in ~~[the]~~ Figure **2** with reference to the example of the ATM cells ATM-Z1, ATM-Z2, up to 2^8 = 256 different logical connections can be addressed within an ATM connection of the basis of the 8 bit long channel identifier CID, all of these logical connections being addressed with the same ATM address [B]-- composed of a VPI ~~[value]~~(virtual path identifier) **value** and of a VCI ~~[value]~~(virtual channel identifier) **value**. In addition, there is the possibility of defining a sub-structure element SE for a transmission of signaling information allocated to the logical connections. For a transmission of payload data allocated to the logical connections, one sub-structure element SE can be defined for every currently required logical connection, so that the transmission capacity can be exactly matched to the current need.

23 For example, four different sub-structure elements SE are shown in ~~[the]~~ Figure **2** that are defined on the basis of different channel identifier CID in the cell header [B]-- referred to below as **the** sub-structure element header 0, 1, 2, 3 [B]-- of the sub-structure elements SE. A payload field I of variable length (0 through 2^6

bytes) can be defined by the 6 bit long length indicator LI in the cell header, so that a data transmission with **a** variable transmission bit rate can be realized for the different logical connections.

24 For a conversion of the packet-oriented data format according to the ATM adaption layer AAL type 2 onto the timeslot-oriented data format according to the TDM method, a TDM channel K0[, ...,] **through** K3 of the timeslot-oriented data format according to the TDM method is allocated to each element SE of an ATM cell ATM-Z1, ATM-Z2 defined for a transmission of payload data. An allocation of a sub-structure element SE to a TDM channel K0[, ...,] **through** K3 [thereby] ensues in a signaling phase preceding the payload transmission. 32 payload channels, which are configured as ISDN-oriented B-channels with a constant transmission bit rate of respectively 64 kbit/s, are generally available for a data transmission in the framework of the timeslot-oriented data format according to the TDM method.

25 In the framework of the conversion of the packet-oriented data format according to the ATM adaption layer AAL type 2 onto the timeslot-oriented data format according to the TDM method, an adaptation of the [B potentially variable B]**(potentially variable)** transmission bit rate of the packet-oriented data format deriving due to the size and the arrival of sub-structure elements SE onto the constant transmission bit rate of 64 kbit/s of the timeslot-oriented data format must additionally ensue. This is achieved in the scope of the first operating mode of the conversion unit UE by an insertion of [what are referred to as filler cells]**"filler cells"** FZ of variable length into the continuous TDM data stream.

26 The sub-structure element SE received via the packet-oriented connecting line PO-VL and packed in ATM cells ATM-Z1, ATM-Z2 must be unpacked in the conversion unit UE. For the conversion of the [B potentially variable B]**(potentially variable)** transmission bit rate deriving due to the size and the arrival of the sub-structure elements SE onto the constant transmission bit rate of 64 kbit/s of the timeslot-oriented data format, [what are referred to as] filler cells FZ are subsequently attached to the sub-structure elements SE containing the payload data. The length of a filler cell FZ is defined by [what is referred to as] a filler cell header FZH. [the] **The** length of a filler cell FZ is [thereby] selected such that the overall transmission bit rate of a sub-structure element SE and of a filler cell FZ

yields a whole multiple of 64 kbit/s. When the transmission bit rate of a sub-structure element SE is higher than 64 kbit/s ~~[B]~~-- i.e., higher than the transmission bit rate of a TDM channel K1~~[, ...,]~~ **through** K4 ~~[B]~~-- the payload data communicated in a sub-structure element SE are divided onto a plurality of TDM channels K1~~[, ...,]~~ **through** K4.

27 In conclusion, these data (sub-structure elements SE and filler cells ~~[FX]~~ **FZ** together) are allocated to a TDM channel K0, ~~[...,]~~ K1 of the timeslot-oriented connecting line ZO-VL declared in the signaling phase and are transmitted via this to the timeslot-oriented switching network module KN.

28 The signaling information communicated from the conversion unit UE to the control unit STE of the communication system PBX in the framework of the signaling phase are converted in the control unit STE into switching-oriented control data for the timeslot-oriented switching network module KN. A switching of the data (sub-structure elements SE and filler cells FZ together) received via the respective TDM channels K0~~[, ...,]~~ **through** K3 of the timeslot-oriented connecting line ZO-VL ensues in the timeslot-oriented switching network module KN on the basis of the switching-oriented control data, i.e., an allocation of a TDM channel of an input line of the timeslot-oriented switching network module KN onto a TDM channel of an output line of the timeslot-oriented switching network module KN.

29 When the payload data to be communicated are to be transmitted anew via the ATM-based communication network ATM-KN to a receiver, the data (sub-structure elements SE and filler cells FZ together) are transmitted from the timeslot-oriented switching network module KN to the conversion unit UE, ~~[wherein]~~ **where** the filler cells FZ are removed from the TDM data stream, so that the data stream then only comprises sub-structure elements SE containing payload data. The sub-structure elements SE to be transmitted are packed in ATM cells ATM-Z1, ATM-Z2 in the conversion unit UE and are communicated via the ATM-based communication network ATM-KN to the addressed recipient. When the data are to be transmitted to, for example, an internal communication terminal device (not shown), then these are transmitted directly to a subscriber line module (not shown) via which the addressed communication terminal device is connected to the communication system PBX.

30 Figure 3 shows a schematic illustration of a conversion of the packet-oriented ATM data format according to the ATM adaption layer AAL type 2 into the timeslot-oriented data format according to the TDM method (time division multiplex) in a second operating mode of the conversion unit UE.

31 In contrast to the first operating mode of the conversion unit UE, no separate filler cells FZ are inserted into the continuous TDM data stream in the second operating mode. An adaptation of the ~~[B potentially variable B]~~**(potentially variable)** transmission bit rate of the packet-oriented data format to the constant transmission bit rate of 64 kbit/s of the timeslot-oriented data format ensues by filling the sub-structure elements SE with filler data FD, so that the overall transmission bit rate of a sub-structure element SE (payload data and filler data FD together) yields a whole multiple of 64 bit/s. This, however, assumes that each TDM channel K0~~[, ...,]~~ **through** K3 additionally has ~~[an]~~ information about the length of the sub-structure elements SE that is transmitted and supplemented with filler data FD allocated to it such that a separation of the payload data to be transmitted from the filler data FD is enabled with the assistance of this information.

32 When, proceeding from the first communication terminal device KE-A, data are to be communicated to the second communication terminal device KE-B, the first communication terminal device KE-A sends the necessary signaling information to the communication system PBX in the framework of a signaling phase preceding the payload transmission, sending these information via a defined sub-structure element SE of a first ATM channel V-A, which is frequently abbreviated as VC (virtual channel) in the literature. The transmitted signaling information are unpacked in the conversion unit UE, converted into the HDLC data format and communicated to the control unit STE.

33 On the basis of the communicated signaling information, a TDM channel ~~[B]--~~ for example, the TDM channel 17 ~~[B]--~~ of the timeslot-oriented connecting line ZO-VL is allocated to the sub-structure elements ~~[Se]~~ **SE** of the first ATM channel V-A that are defined for the transmission of the payload data from the first communication terminal device KE-A to the communication system PBX. ~~[Further]~~ **Furthermore**, the communicated signaling information are converted into switching-oriented control data for the timeslot-oriented switching network module KN. The switching-oriented

control data define which input TDM channel [B]-- for example, the TDM channel 17 of the timeslot-oriented connecting line ZO-VL [B]-- is connected to which output TDM channel of the timeslot-oriented switching network module KN [B]-- for example, the TDM channel 23 of the timeslot-oriented connecting line ZO-VL.

34 Subsequently, the first communication terminal device KE-A packs payload data to be transmitted into sub-structure elements SE that are in turn packed in ATM cells ATM-Z1, ATM-Z2 and subsequently communicated via the first ATM channel V-A to the communication system PBX. The sub-structure elements SE are unpacked from the ATM cells ATM-Z1, ATM-Z2 in the conversion unit UE. In a next step, the transmission bit rate deriving due to the size and the arrival of the sub-structure elements SE is matched to the constant transmission bit rate of 64 kbit/s by inserting filler cells FZ according to the first operating mode of the conversion unit UE.

35 The data [B]-- composed of sub-structure elements SE and filler cells FZ [B]-- are subsequently forwarded via the TDM channel 17 of the timeslot-oriented connecting line ZO-VL to the timeslot-oriented switching network module KN. The data are switched onto the TDM channel 23 of the timeslot-oriented connecting line ZO-VL by the timeslot-oriented switching network module KN and are sent back to the conversion unit UE. The filler cells FZ are removed from the continuous data stream in the conversion unit UE, so that the data stream is not composed only of sub-structure elements SE containing payload data. These sub-structure elements SE are subsequently packed into ATM cells ATM-Z1, ATM-Z2 and transmitted to the second communication terminal device KE-B via a second ATM channel V-B.

36 The above-described method is illustrative of the principles of the present invention. Numerous modifications and adaptations thereof will be readily apparent to those skilled in this art without departing from the spirit and scope of the present invention.

ABSTRACT

37 Data packets (ATM-Z1, ATM-Z2) partitioned into substructure elements (SE) are set up for data transmission via the packet oriented data transmission path. Channels with a time slot oriented format (TDM) are assigned to the data received via the packet oriented data transmission path by a conversion unit (UE). The converted data is then switched via a time slot oriented switching matrix module (KN).

METHOD FOR SWITCHING DATA RECEIVED VIA A PACKET-ORIENTED DATA TRANSMISSION PATH

The significance of transmission and switching techniques for high data transmission rates (above 100 Mbit/s) is increasing due to the increasing need for a transmission of video information in modern communications technology such as, for example, still and moving images in picture telephony applications or the presentation of high-resolution graphics at modern data processing systems. A known data transmission method for high transmission bit rates is what is referred to as the asynchronous transfer mode (ATM). A data transmission on the basis of the asynchronous transfer mode currently enables a variable transmission bit rate of up to 622 Mbit/s.

In the transmission technique known as asynchronous transfer mode (ATM), data packets having a fixed length, what are referred to as ATM cells, are used for the data transport. An ATM cell is composed of a cell header that is five bytes long and contains the switching data relevant for the transport of an ATM cell and of a 48 byte long payload field. Only data allocated to one logical connection – frequently referred to as virtual channel VC or ATM channel in the literature – are thereby transmitted in the payload field of an ATM cell.

US Published Application US-A-5784371 discloses a communication network formed of a plurality of communication systems that are connected to one another via an ATM network. The communication systems respectively comprise a timeslot-oriented switching network module for a connection of timeslot-oriented terminal devices to the respective communication system, whereby a bidirectional switching of data to be exchanged bet [...] device and the packet-oriented ATM network ensues with the timeslot-oriented switching network modules.

The German Patent Application bearing the serial number 198 187 76.9 has already disclosed a method that enables a transmission of data belonging to

different logical connections in the payload region of one or, respectively, several ATM cells. To this end, what are referred to as sub-structure elements having a variable payload field 0 through 64 bytes long is defined in the payload field of an ATM cell, said sub-structure elements being capable of being respectively allocated to a logical connection via an address field in the cell header of the sub-structure element. Due to the 8-bit long address field in the cell header of a sub-structure element, a maximum of $2^8 = 256$ different logical connections can be addressed. Additionally, at least one sub-structure element is reserved for a transmission of signaling information allocated to the logical connections.

The article by Mauger, R., et al., "ATM Adaptation Layer Switching" ISS, World Telecommunications Congress (International Switching Symposium), Ca, Toronto, Pinnacle group, pages 207-214, XP000720525, discloses an arrangement for a switching of data received via a timeslot-oriented data transmission link and a packet-oriented data transmission link. The arrangement thereby comprises both a timeslot-oriented switching network module as well as a packet-oriented switching network module. A switching of data received via the packet-oriented data transmission link and to be forwarded via a packet-oriented data transmission link as well thereby ensues with the packet-oriented switching network module.

An object of the present invention is to specify an alternative method with which a switching of data that are received via a packet-oriented data transmission link and are to be forwarded is enabled.

Proceeding from the features of the preamble of patent claim 1, this object is inventively achieved by the characterizing features thereof.

A critical advantage of the inventive method is then comprised therein that a switching of data allocated to different logical connections and transmitted in one or, respectively, several data cells can ensue via a traditional timeslot-oriented switching network module. A development of a switching network module designed for the

present packet-oriented data format and a signaling adapted thereto are thus not necessary.

Advantageous developments of the invention are recited in the subclaims.

One advantage of developments of the invention defined in the subclaims is comprised, among other things, therein that the insertion of filler cells or, respectively, of filler data into a sub-structure element during the conversion of a packet-oriented data format into a timeslot-oriented data format makes a switching of compressed data possible without preceding decompression. A quality loss in the switching of compressed data is thus avoided.

An exemplary embodiment of the invention is explained in greater detail below on the basis of the drawing.

Thereby shown are:

Figure 1 a structogram of the schematic illustration of the critical function units participating in the inventive method;

Figure 2 a structogram of the schematic illustration of the conversion of a packet-oriented data format into a timeslot-oriented data format according to a first operating mode of a conversion unit;

Figure 3 a structogram of the schematic illustration of the conversion of the packet-oriented data format into the timeslot-oriented data format according to a second operating mode of the conversion unit.

Figure 1 shows a schematic illustration of a communication system PBX. The communication system PBX comprises subscriber or, respectively, network line/trunk modules – a line/trunk module ABG is shown by way of example – for the connection of communication terminal devices or, respectively, for a connection to a communication network – for example, an ISDN-oriented communication network, an analog communication network, a radio communication network or an ATM-based communication network.

Further, the communication system PBX contains a timeslot-oriented switching network module KN comprising a plurality of bidirectional, time-division multiplex-oriented switching terminals KA, whereby the time-division multiplex-oriented switching terminals KA are fashioned as PCM terminals (pulse code modulation), also referred to as PCM highways, speech highways or S_{2M} terminals. Given an internal data transmission of the communication system, a PCM highway generally comprises 32 payload channels that are fashioned as ISDN-oriented B-channels (integrated services digital network) with a respective transmission bit rate of 64 kbit/s.

A line unit AE and a conversion unit UE are arranged on the line/trunk module ABG. The communication system PBX is connected to an ATM-based communication network ATM-KN via a network interface NA of the line unit AE, said ATM-based communication network ATM-KN being composed of a plurality of communication systems connected to one another. A first and a second communication terminal device KE-A, KE-B are connected to the ATM-based communication network ATM_KN. The line unit AE is connected to a bidirectional, packet-oriented terminal SK of the conversion unit UE via a bidirectional, packet-oriented terminal SK. [sic]

The conversion unit UE, further, is connected to a switching terminal KA of the timeslot-oriented switching network module KN via a bidirectional, time-division multiplex-oriented switching terminal KA. [sic] Via further switching terminals KA (not shown), the timeslot-oriented switching network module KN is

respectively connected to a bidirectional time-division multiplex-oriented terminal SK of further subscriber or, respectively, line/trunk modules (not shown) arranged in the communication system PBX.

A bidirectional conversion between the packet-oriented data format of a connecting line PO-VL between the conversion unit UE and the line unit AE and the timeslot-oriented data format of a connecting line ZO-VL between the conversion unit UE and the timeslot-oriented switching network module KN ensues with the conversion unit UE according to two different operating modes of said conversion unit UE that are described in greater detail below.

Further, a control unit STE comprising a plurality of control terminals S1, S2 is arranged in the communication system PBX. The control unit STE is connected to a control input SE of the timeslot-oriented switching network module KN via a control terminal S2, and is connected to a control input SE of the line/trunk module ABG via a control terminal S1. The control unit STE is connected to control inputs of further subscriber or, respectively, line/trunk modules arranged in the communication system PBX via further control terminals (not shown). A communication of signaling information between the control unit STE and the timeslot-oriented switching network module KN or, respectively, the line/trunk module ABG thereby ensues according to the HDLC data format (high level data link control).

Figure 2 shows a schematic illustration of a conversion of the packet-oriented ATM data format according to the ATM adaption layer AAL type 2 into the timeslot-oriented data format according to the TDM method (time-division multiplex) in a first operating mode of the conversion unit UE. A data transmission in the framework of the packet-oriented ATM data format ensues via ATM cells ATM-Z1, ATM-Z2. An ATM cell ATM-Z1, ATM-Z2 is composed of a five byte long cell header H containing the switching data relevant for the transport of an ATM cell ATM-Z1, ATM-Z2 and of a 48 byte long payload field.

In a data transmission in the framework of the packet-oriented ATM data format according to the ATM adaption layer AAL type 2, there is the possibility of

subdividing the payload area of an ATM cell ATM-Z1, ATM-Z2 into sub-structure elements SE. The adaptation of the ATM data format – also frequently referred to as "ATM layer" (layer 2) in the literature – to the switching layer (layer 3) according to the OSI reference model (open systems interconnection) thereby ensues with what is referred to as the ATM adaption layer AAL.

A sub-structure element SE according to the ATM adaption layer AAL type 2 is composed of a 3 byte long cell header and of a variable-length payload area I (0 through 64 bytes). The cell header of a sub-structure element SE is subdivided into an 8 bit long channel identifier CID, a 6 bit long length indicator LI, a 5 bit long transmitter-receiver indication UUI (user-to-user indication) and a 5 bit long cell header checksum HEC (header error control).

As a result of the subdivision of an ATM connection with the assistance of sub-structure elements SE into mutually independent data streams, as shown in the Figure with reference to the example of the ATM cells ATM-Z1, ATM-Z2, up to $2^8 = 256$ different logical connections can be addressed within an ATM connection of the basis of the 8 bit long channel identifier CID, all of these logical connections being addressed with the same ATM address – composed of a VPI value (virtual path identifier) and of a VCI value (virtual channel identifier). In addition, there is the possibility of defining a sub-structure element SE for a transmission of signaling information allocated to the logical connections. For a transmission of payload data allocated to the logical connections, one sub-structure element SE can be defined for every currently required logical connection, so that the transmission capacity can be exactly matched to the current need.

For example, four different sub-structure elements SE are shown in the Figure that are defined on the basis of different channel identifier CID in the cell header – referred to below as sub-structure element header 0, 1, 2, 3 – of the sub-structure elements SE. A payload field I of variable length (0 through 2^6 bytes) can be defined by the 6 bit long length indicator LI in the cell header, so that a data

transmission with variable transmission bit rate can be realized for the different logical connections.

For a conversion of the packet-oriented data format according to the ATM adaption layer AAL type 2 onto the timeslot-oriented data format according to the TDM method, a TDM channel K0, ..., K3 of the timeslot-oriented data format according to the TDM method is allocated to each element SE of an ATM cell ATM-Z1, ATM-Z2 defined for a transmission of payload data. An allocation of a sub-structure element SE to a TDM channel K0, ..., K3 thereby ensues in a signaling phase preceding the payload transmission. 32 payload channels, which are configured as ISDN-oriented B-channels with a constant transmission bit rate of respectively 64 kbit/s, are generally available for a data transmission in the framework of the timeslot-oriented data format according to the TDM method.

In the framework of the conversion of the packet-oriented data format according to the ATM adaption layer AAL type 2 onto the timeslot-oriented data format according to the TDM method, an adaptation of the – potentially variable – transmission bit rate of the packet-oriented data format deriving due to the size and the arrival of sub-structure elements SE onto the constant transmission bit rate of 64 kbit/s of the timeslot-oriented data format must additionally ensue. This is achieved in the scope of the first operating mode of the conversion unit UE by an insertion of what are referred to as filler cells FZ of variable length into the continuous TDM data stream.

The sub-structure element SE received via the packet-oriented connecting line PO-VL and packed in ATM cells ATM-Z1, ATM-Z2 must be unpacked in the conversion unit UE. For the conversion of the – potentially variable – transmission bit rate deriving due to the size and the arrival of the sub-structure elements SE onto the constant transmission bit rate of 64 kbit/s of the timeslot-oriented data format, what are referred to as filler cells FZ are subsequently attached to the sub-structure elements SE containing the payload data. The length of a filler cell FZ is defined by what is referred to as a filler cell header FZH. the length of a filler cell FZ is thereby

selected such that the overall transmission bit rate of a sub-structure element SE and of a filler cell FZ yields a whole multiple of 64 kbit/s. When the transmission bit rate of a sub-structure element SE is higher than 64 kbit/s – i.e. higher than the transmission bit rate of a TDM channel K1, ..., K4 – the payload data communicated in a sub-structure element SE are divided onto a plurality of TDM channels K1, ..., K4.

In conclusion, these data (sub-structure elements SE and filler cells FX together) are allocated to a TDM channel K0, ... K1 of the timeslot-oriented connecting line ZO-VL declared in the signaling phase and are transmitted via this to the timeslot-oriented switching network module KN.

The signaling information communicated from the conversion unit UE to the control unit STE of the communication system PBX in the framework of the signaling phase are converted in the control unit STE into switching-oriented control data for the timeslot-oriented switching network module KN. A switching of the data (sub-structure elements SE and filler cells FZ together) received via the respective TDM channels K0, ..., K3 of the timeslot-oriented connecting line ZO-VL ensues in the timeslot-oriented switching network module KN on the basis of the switching-oriented control data, i.e. an allocation of a TDM channel of an input line of the timeslot-oriented switching network module KN onto a TDM channel of an output line of the timeslot-oriented switching network module KN.

When the payload data to be communicated are to be transmitted anew via the ATM-based communication network ATM-KN to a receiver, the data (sub-structure elements SE and filler cells FZ together) are transmitted from the timeslot-oriented switching network module KN to the conversion unit UE, wherein the filler cells FZ are removed from the TDM data stream, so that the data stream then only comprises sub-structure elements SE containing payload data. The sub-structure elements SE to be transmitted are packed in ATM cells ATM-Z1, ATM-Z2 in the conversion unit UE and are communicated via the ATM-based communication network ATM-KN to the addressed recipient. When the data are to be transmitted to,

for example, an internal communication terminal device (not shown), then these are transmitted directly to a subscriber line module (not shown) via which the addressed communication terminal device is connected to the communication system PBX.

Figure 3 shows a schematic illustration of a conversion of the packet-oriented ATM data format according to the ATM adaption layer AAL type 2 into the timeslot-oriented data format according to the TDM method (time division multiplex) in a second operating mode of the conversion unit UE.

In contrast to the first operating mode of the conversion unit UE, no separate filler cells FZ are inserted into the continuous TDM data stream in the second operating mode. An adaptation of the – potentially variable – transmission bit rate of the packet-oriented data format to the constant transmission bit rate of 64 kbit/s of the timeslot-oriented data format ensues by filling the sub-structure elements SE with filler data FD, so that the overall transmission bit rate of a sub-structure element SE (payload data and filler data FD together) yields a whole multiple of 64 bit/s. This, however, assumes that each TDM channel K0, ..., K3 additionally has an information about the length of the sub-structure elements SE that is transmitted and supplemented with filler data FD allocated to it such that a separation of the payload data to be transmitted from the filler data FD is enabled with the assistance of this information.

When, proceeding from the first communication terminal device KE-A, data are to be communicated to the second communication terminal device KE-B, the first communication terminal device KE-A sends the necessary signaling information to the communication system PBX in the framework of a signaling phase preceding the payload transmission, sending these information via a defined sub-structure element SE of a first ATM channel V-A, which is frequently abbreviated as VC (virtual channel) in the literature. The transmitted signaling information are unpacked in the conversion unit UE, converted into the HDLC data format and communicated to the control unit STE.

On the basis of the communicated signaling information, a TDM channel – for example, the TDM channel 17 – of the timeslot-oriented connecting line ZO-VL

is allocated to the sub-structure elements Se of the first ATM channel V-A that are defined for the transmission of the payload data from the first communication terminal device KE-A to the communication system PBX. Further, the communicated signaling information are converted into switching-oriented control data for the timeslot-oriented switching network module KN. The switching-oriented control data define which input TDM channel – for example, the TDM channel 17 of the timeslot-oriented connecting line ZO-VL – is connected to which output TDM channel of the timeslot-oriented switching network module KN – for example, the TDM channel 23 of the timeslot-oriented connecting line ZO-VL.

Subsequently, the first communication terminal device KE-A packs payload data to be transmitted into sub-structure elements SE that are in turn packed in ATM cells ATM-Z1, ATM-Z2 and subsequently communicated via the first ATM channel V-A to the communication system PBX. The sub-structure elements SE are unpacked from the ATM cells ATM-Z1, ATM-Z2 in the conversion unit UE. In a next step, the transmission bit rate deriving due to the size and the arrival of the sub-structure elements SE is matched to the constant transmission bit rate of 64 kbit/s by inserting filler cells FZ according to the first operating mode of the conversion unit UE.

The data – composed of sub-structure elements SE and filler cells FZ – are subsequently forwarded via the TDM channel 17 of the timeslot-oriented connecting line ZO-VL to the timeslot-oriented switching network module KN. The data are switched onto the TDM channel 23 of the timeslot-oriented connecting line ZO-VL by the timeslot-oriented switching network module KN and are sent back to the conversion unit UE. The filler cells FZ are removed from the continuous data stream in the conversion unit UE, so that the data stream is not composed only of sub-structure elements SE containing payload data. These sub-structure elements SE are subsequently packed into ATM cells ATM-Z1, ATM-Z2 and transmitted to the second communication terminal device KE-B via a second ATM channel V-B.

Patent Claims

1. Method for switching data that are received via a packet-oriented data transmission link and are to be forwarded, whereby data packets (ATM-Z1, ATM-Z2) subdivided into sub-structure elements (SE) are established for a data transmission via the packet-oriented data transmission link, characterized in that
an allocation of the data received via the packet-oriented data transmission link to channels of a timeslot-oriented data format TDM formed of a periodic sequence of channel-individual information segments is undertaken such by a conversion unit (UE) that the data allocated to a sub-structure element (SE) are allocated to at least one channel of the timeslot-oriented data format (TDM);
in that a switching of the data converted into the timeslot-oriented data format ensues via a timeslot-oriented switching network module (KN); and
in that the timeslot-oriented data are converted back into the packet-oriented data format and are transmitted via the packet-oriented data transmission link.

2. Method according to claim 1, characterized in that a data transmission via the packet-oriented data transmission link ensues according to the ATM data format (asynchronous transfer mode).

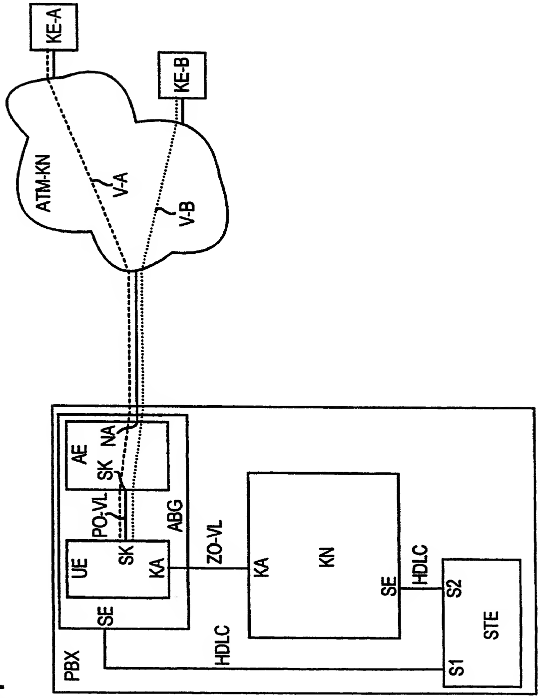
3. Method according to one of the preceding claims, characterized in that a sub-structure element (SE) is reserved for the transmission of signaling information allocated to data transmitted via the packeted-oriented data transmission link.

4. Method according to claim 3, characterized in that the received signaling information are communicated from the conversion unit (UE) to a control unit (STE) wherein the signaling information are converted into switching-oriented control data for the timeslot-oriented switching network module (KN).

5. Method according to one of the preceding claims, characterized in that filler cells (FZ) are inserted for an adaptation of the transmission bit rate deriving due to the arrival and the size of sub-structure elements (SE) to the transmission bit rate of a channel.

6. Method according to one of the claims 1 through 4, characterized in that filler data (FD) are inserted into a sub-structure element (SE) for an adaptation of the transmission bit rate deriving due to the arrival and the size of sub-structure elements (SE) to the transmission bit rate of a channel.

7. Method according to claim 6, characterized in that an information about the plurality of payload data communicated in the channel and an information about the plurality of filler data (FD) communicated in the channel is transmitted for each channel.


KE-A
KE-B
ATM-KN
V-A
V-B
PBX
AE
SK
NA
PO-VL
ABG
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SE
ZO-VL
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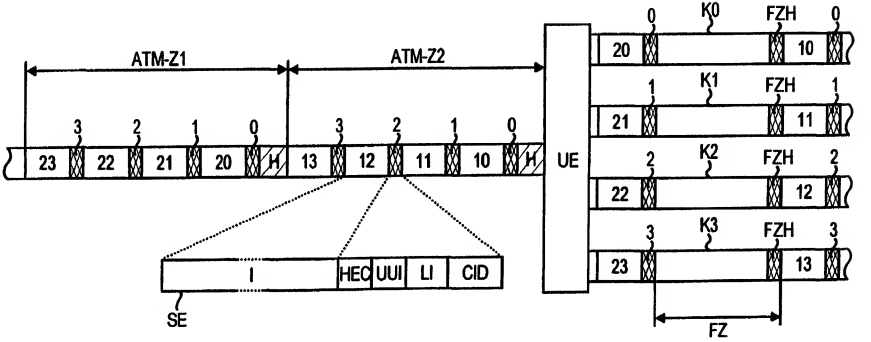
KN
SE
HDLC
S2
STE
S1
HDLC

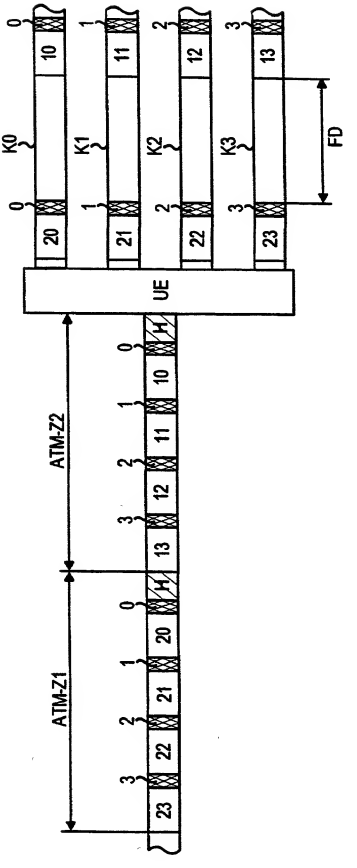
Fig 1

Fig 2



09/744079

Fig 3



Declaration and Power of Attorney For Patent Application
Erklärung Für Patentanmeldungen Mit Vollmacht
German Language Declaration

Als nachstehend benannter Erfinder erkläre ich hiermit an Eides Statt

As a below named inventor, I hereby declare that:

dass mein Wohnsitz, meine Postanschrift, und meine Staatsangehörigkeit den im Nachstehenden nach meinem Namen aufgeführten Angaben entsprechen,

My residence, post office address and citizenship are as stated below next to my name,

dass ich, nach bestem Wissen der ursprüngliche, erste und alleinige Erfinder (falls nachstehend nur ein Name angegeben ist) oder ein ursprünglicher, erster und Miterfinder (falls nachstehend mehrere Namen aufgeführt sind) des Gegenstandes bin, für den dieser Antrag gestellt wird und für den ein Patent beantragt wird für die Erfindung mit dem Titel:

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

Verfahren zum Vermitteln von über eine paket-orientierte Datenübertragungsstrecke empfangenen Daten

deren Beschreibung

the specification of which

(zutreffendes ankreuzen)

☒ hier beigefügt ist.

☐ am _____ als PCT internationale Anmeldung PCT Anmeldungsnummer _____ eingereicht wurde und am _____ abgeändert wurde (falls tatsächlich abgeändert).

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☐ is attached hereto.

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Ich bestätige hiermit, dass ich den Inhalt der obigen Patentanmeldung einschliesslich der Ansprüche durchgesehen und verstanden habe, die eventuell durch einen Zusatzantrag wie oben erwähnt abgeändert wurde.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims as amended by any amendment referred to above.

Ich erkenne meine Pflicht zur Offenbarung irgendwelcher Informationen, die für die Prüfung der vorliegenden Anmeldung in Einklang mit Absatz 37, Bundesgesetzbuch, Paragraph 1 56(a) von Wichtigkeit sind, an

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1 56(a)

Ich beanspruche hiermit ausländische Prioritätsvorteile gemäss Abschnitt 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 119 aller unten angegebenen Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde, und habe auch alle Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde nachstehend gekennzeichnet, die ein Anmeldedatum haben, das vor dem Anmeldedatum der Anmeldung liegt, für die Priorität beansprucht wird

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Form PTO-FB-240 (8-83) Patent and Trademark Office-U.S. DEPARTMENT OF COMMERCE

German Language Declaration

Prior foreign appplications
Priorität beansprucht

			Priority Claimed	
198 32 999.7	Germany	22. Juli 1998	☒	☐
(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	Yes Ja	No Nein
			☐	☐
(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	Yes Ja	No Nein
			☐	☐
(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	Yes Ja	No Nein

Ich beanspruche hiermit gemäss Absatz 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 120, den Vorzug aller unten aufgeführten Anmeldungen und falls der Gegenstand aus jedem Anspruch dieser Anmeldung nicht in einer früheren amerikanischen Patentanmeldung laut dem ersten Paragraphen des Absatzes 35 der Zivilprozeßordnung der Vereinigten Staaten, Paragraph 122 offenbart ist, erkenne ich gemäss Absatz 37, Bundesgesetzbuch, Paragraph 1 56(a) meine Pflicht zur Offenbarung von Informationen an, die zwischen dem Anmeldedatum der früheren Anmeldung und dem nationalen oder PCT internationalen Anmeldedatum dieser Anmeldung bekannt geworden sind.

I hereby claim the benefit under Title 35. United States Code. §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §122, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occured between the filing date of the prior application and the national or PCT international filing date of this application

(Application Serial No.) (Anmeldeseriennummer)	(Filing Date) (Anmeldedatum)	(Status) (patentiert, anhängig, aufgegeben)	(Status) (patented, pending, abandoned)
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POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. *(list name and registration number)*

And I hereby appoint

Messrs. John D. Simpson (Registration No. 19,842) Lewis T Steadman (17,074), William C Stueber (16,453), P. Phillips Connor (19,259), Dennis A. Gross (24,410), Marvin Moody (16,549), Steven H. Noll (28,982), Brett A Valiquet (27,841), Thomas I Ross (29,275), Kevin W Guynn (29,927), Edward A Lehmann (22,312), James D Hobart (24,149), Robert M Barrett (30,142), James Van Santen (16,584), J. Arthur Gross (13,615), Richard J. Schwarz (13,472) and Melvin A. Robinson (31,870), David R. Metzger (32,919), John R. Garrett (27,888) all members of the firm of Hill, Steadman & Simpson, A Professional Corporation.

19 & Cont.

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Ext. _____

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Send Correspondence to:

HILL, STEADMAN & SIMPSON
A Professional Corporation
85th Floor Sears Tower, Chicago, Illinois 60606

Voller Name des einzigen oder ursprünglichen Erfinders:	Full name of sole or first inventor
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Unterschrift des Erfinders: Datum: Klaus Hünlich 28.6.99	Inventor's signature: Date
Wohnsitz: D-85467 Neuching, Germany DEX	Residence
Staatsangehörigkeit: Bundesrepublik Deutschland	Citizenship
Postanschrift: Birkenstr. 4 D-85467 Neuching Bundesrepublik Deutschland	Post Office Address
Voller Name des zweiten Miterfinders (falls zutreffend): FRAAS, Wolfgang	Full name of second joint inventor, if any.
Unterschrift des Erfinders: Datum: 28.6.99	Second Inventor's signature: Date
Wohnsitz: D-82515 Wolfratshausen, Germany DEX	Residence
Staatsangehörigkeit: Bundesrepublik Deutschland	Citizenship
Postanschrift: Karwendelstr. 2 D-82515 Wolfratshausen Bundesrepublik Deutschland	Post Office Address

(Bitte entsprechende Informationen und Unterschriften im Falle von dritten und weiteren Miterfindern angeben).

(Supply similar information and signature for third and subsequent joint inventors).

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UNDER THE PATENT COOPERATION TREATY--CHAPTER II

APPLICANT(S):	KLAUS HÜNLICH ET AL.
ATTORNEY DOCKET NO.:	P00,1957
INTERNATIONAL APPLICATION NO:	PCT/DE 99/01946
INTERNATIONAL FILING DATE:	01 JULY 1999
INVENTION:	METHOD FOR SWITCHING DATA RECEIVED VIA A PACKET-ORIENTED DATA TRANSMISSION PATH

Assistant Commissioner for Patents,
Washington D.C. 20231

APPOINTMENT OF ASSOCIATE POWER OF ATTORNEY

Dear Sir:

I am an attorney designated on the Power of Attorney for the above-referenced application. I hereby appoint Mark Bergner (Reg. No. 45,877) as an associate attorney, with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.

Submitted by,

(Reg. No. 31,870)
Melvin A. Robinson
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Attorney for Applicant(s)

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Assistant Commissioner for Patents,
Washington D.C. 20231

CHANGE OF ADDRESS OF APPLICANTS REPRESENTATIVE

S I R:

Members of the firm of Hill & Simpson designated on the original Power of Attorney have merged into the firm of Schiff Hardin & Waite. All future correspondence for the above-referenced application therefore should be sent to the following address:

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